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Introduction: In 2010, Desert Research and Technology Studies (Desert RATS), NASA's annual field exercise designed to test spacesuit and rover technologies, will include a first generation lunar habitat facility, the Habitat Demonstration Unit (HDU). The habitat will participate in joint operations in northern Arizona with the Lunar Electric Rover (LER) and will be used as a multi-use laboratory and working space. A Geology Laboratory or GeoLab is included in the HDU design.

Historically, science participation in Desert RATS exercises has supported the technology demonstrations with geological traverse activities that are consistent with preliminary concepts for lunar surface science Extravehicular Activities (EVAs). Next year's HDU demonstration is a starting point to guide the development of requirements for the Lunar Surface Systems Program and test initial operational concepts for an early lunar excursion habitat that would follow geological traverses along with the LER. For the GeoLab, these objectives are specifically applied to support future geological surface science activities. The goal of our GeoLab is to enhance geological science returns with the infrastructure that supports preliminary examination, early analytical characterization of key samples, and high-grading lunar samples for return to Earth [1, 2].

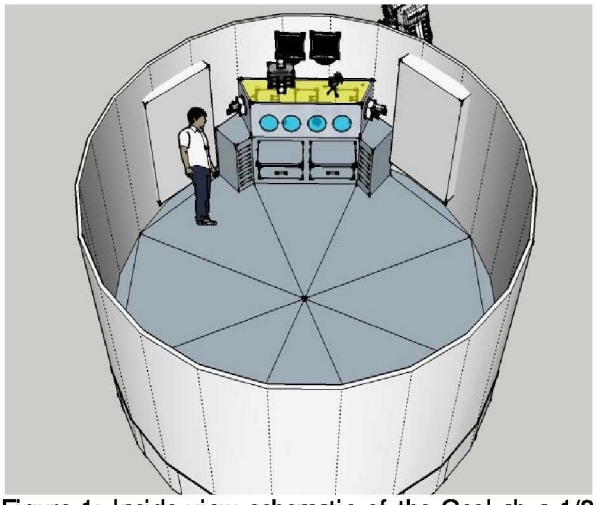

Figure 1: Inside view schematic of the GeoLab a 1/8 section of the HDU, including a glovebox for handling and examining geological samples. Other outfitting facilities are not depicted in this figure.

GeoLab Description: The centerpiece of the GeoLab is a glovebox, allowing for samples to be brought into the habitat in a protected environment for preliminary examination (see Fig. 1). The glovebox will be attached to the habitat bulkhead and contain three sample pass-through antechambers that would allow direct transfer of samples from outside the HDU to inside the glovebox. We will evaluate the need for redundant chambers, and other uses for the glovebox antechambers, such as a staging area for additional tools or samples. The sides of the glovebox are designed with instrument ports and additional smaller ports for cable pass-through, imagery feeds and environmental monitoring. This first glovebox version will be equipped with basic tools for manipulating, viewing, and early analysis of samples. The GeoLab was also designed for testing additional analytical instruments in a field setting.

Operational Evaluation: The GeoLab will be evaluated based on how well it interfaces with the rover and EVA operations, as well as the potential science value a shirt-sleeve laboratory will bring to a lunar mission. We will design tests to evaluate the laboratory facility in general, the glovebox design and operations, and the instruments used with the glovebox. We will use these field tests to develop and assess preliminary crew and science support "back-room" procedures, and to test sample handling protocols for key samples in order to best support informed decisions about planned traverses, sample priorities and sample return [1, 2].

Anticipated outcomes: GeoLab will enable the development of advanced laboratory concepts (both lab & field tools) and the sample handling protocols required for efficient field campaigns and initial curation efforts that control contamination and preserve pristine samples collected during exploration missions. Assessment of the laboratory operations will drive the definition of requirements and the advancement of new technologies for handling and examining extraterrestrial samples, and transporting them back to Earth.

GeoLab capabilities and the derived operational concepts will also provide a venue for participation by the science team in surface mission planning for future exploration missions. Through GeoLab deployment and operations, we will gain a practical understanding of the field operations and performance of a specific habitat laboratory facility so that we can confidently work with mission planners to optimize astronaut activities on the lunar surface.

References: [1] Treiman, A.H. (1993) Curation of Geological Materials at a Lunar Outpost, JSC-26194 and Office of the Curator Publication #187. [2] Shearer, C. et al. (2009) Review of Sample Acquisition and Curation During Lunar Surface Activities, LEAG and CAPTEM White paper, in press.